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BEFORE THE

FEDERAL TRADE COMMISSION

Cigarettes and Related Matters

028660

Methods to be Employed in Determining

Tar and Nicotine Content

ADDITIONAL OBSERVATIONS

A Critique Of The March, 1967 Roswell Park Memorial Institute Report On Cigarette Testing.

Since the submission of our Memorandum of December 20, 1966, the undersigned Companies have continued to cooperate fully with the Commission in making available through their scientific personnel the accumulated experience of the industry in the testing and reporting of particulate matter (PM) and nicotine in cigarette smoke. *

In the March 1967 issue of "Cancer," a publication of the American Cancer Society, there appeared an article entitled "Tar and Nicotine Retrieval From Fifty-Six Brands of Cigarettes," by Moore, Bross, Shamberger and Bock of Roswell Park Memorial Institute, Buffalo, New York. ** For convenience of reference, a photocopy of this article is attached.

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* This cooperation was reported by Chairman Paul Rand Dixon to the House Committee on Interstate and Foreign Commerce on March 16, 1967, Tr. 660-61.

** This paper is reported to have been received for publication on December 23, 1966.

Source: https://www.industrydocuments.ucsf.edu/docs/pzwk0001

An examination of this study -- and the nature of the sample tested, the methodology employed, the statistical deficiencies disclosed, and the plainly deceptive method of reporting and ranking PM and nicotine values in a manner that the data cannot support -- underscores the recommendations we have previously made to the Commission. * Because these disclosed deficiencies and deceptions are illuminating on the questions considered by the Commission at its Public Hearing, November 30, 1966, an analysis of the Moore, et al., paper may be of utility to the Commission in its formulation of sampling, testing methodology, and reporting.

I

To begin with, in suggesting that the testing and reporting of PM and nicotine are "useful in comparing the potential biological effects of different kinds of cigarettes," the Moore paper simply repeats the unsupported assertions that have been offered since early in 1966. It furnishes no new medical data, as indeed none has been offered by anyone, that low PM and nicotine are related in any way to smoking and health. Nothing

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* Memorandum submitted August 5th, 1966; Supplementary Memorandum submitted September 9th, 1966; Memorandum and Technical Data and Recommendations submitted on November 28th, 1966; and Supplemental Observations following the November 30th, 1966 Hearing.

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in the Moore paper on testing and reporting offers any scientific basis for changing the conclusions in the 1964 Report of the Surgeon General's Advisory Committee, concurring in the long-held view of the Federal Trade Commission, that the so-called "tar" and nicotine content of cigarette smoke had not been proved to have health significance. The confirmation of that conclusion by the Surgeon General, the Commission Chairman, and others in the 1965 Congressional Hearings still stands.

II

As a summary guide to this critique of the inter-related deficiencies in the Moore report, the key points to keep in mind are these:

1. The sample was far too small and not representative for any purpose. Almost all cigarettes were bought at a single retail location, and generally only 12 cigarettes of each brand were smoked.

2. The sample of 12 cigarettes tested was further made unrepresentative because of a series of manipulations on the cigarettes purchased.

3. The results reported are unreliable and plainly deceptive. Moore's data itself shows that a specifically reported "tar" level of 27 milligrams could in reality have been between

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25 mg. and 29 mg., and a reported "tar" level of 33 mg. could in fact have been between 30 mg. and 36 mg.

4. Despite these plainly revealed statistical deficiencies, the results are reported to the nearest tenth of a milligram. In fact, the real results could well have varied by several milligrams.

5. Table 2 giving Moore's results and rankings does not reveal these margins of error. Instead, the results and rankings are segregated and stated separately in that Table, presumably for public consumption. Indeed, they have already been extensively reported in the press.

6. Moore's ranking of results to the nearest tenth of a milligram is scientifically not forthright and per se deceptive because the true values can lie within confidence intervals (that is, revealed margins of error) of up to 6 milligrams. The Table of results and rankings, however, does not on its face, or as publicly and widely discussed, show those margins of unreliability.

7. When statistically analyzed, the data in the Moore report establishes initially that a minimum sample of 200 cigarettes is necessary for reliable testing and ranking of brands.

8. The deception in the Moore report is aggravated by the failure to report results both on a per puff and a per cigarette basis. Puff data is available in the Moore study, and the

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failure to report it makes for a marked distortion. Moore's assumption that the results in rankings would be substantially equivalent on both bases is flatly contradicted by his own data. In fact, the results would differ markedly in many instances.

9. The Moore selection of a basic butt length of 23 millimeters, a minimum rather than an average, distorts the Ogg Method. That butt length selection is unfounded on references given by Moore.

Thus the cardinal significance of the published Moore paper is that within its own four corners it demonstrates that dangerously deceptive results will flow from inadequate sampling, and that false implication of precision in reporting PM and nicotine figures and in ranking brands by differences of tenths of a milligram would be deceptive.

These disclosed deficiencies and distortions indicate why in its own effort to establish a scientifically adequate method for testing cigarettes and a reliable method of reporting results the Commission should follow the recommendations previously furnished to it by the research staff of the undersigned Companies.

III

SAMPLING DEFICIENCIES

"Selection of Cigarettes: The procedures employed in this study or recommended for general

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> use do not necessarily provide a true picture of all cigarettes bearing a specific brand name . . . . most of the cigarettes were obtained from a single retail outlet and cigarettes purchased in other localities might have given somewhat different results." (Moore, p. 330).

The permeating error that infects the Moore paper throughout is the paucity of the sample tested and its admittedly unrepresentative character. Ostensibly to provide comparative PM and nicotine analytical values on available cigarette brands -- arrayed without qualification in Table 2, page 326 -- Moore and his colleagues tested only 12 cigarettes from each brand.*

What is striking is the absence of any information as to the quantity of cigarettes purchased from which these 12 cigarettes were selected and the manipulations performed, on whatever quantity was purchased, in order to select the mere dozen cigarettes actually tested.

Basically, the Moore sample was not representative. As has been previously urged upon the Commission, to obtain a truly representative sample, for reporting on a national basis, the initial quantities picked up should take into account the

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* As will be seen, infra, p. 12, this miniscule and inadequate sample required resort to questionable statistical procedures in the grouping of variances for brands.

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geographical location of consumers which reflect the varying climatic conditions throughout the United States, and comprehend the varying conditions of the basic samples, e.g., time of manufacture, conditions of distribution and storage, and insofar as possible should embrace a true cross section of what is offered to the consumer throughout the United States under the particular brand. It was on this basis that we recommended to the Commission that there should be pick-ups from at least 50 cities throughout the country.

In the cigarettes tested by Moore -- on the basis of which both the rankings are reported and sweeping conclusions offered -- no cognizance was taken of these factors. Instead, "cigarettes of 56 brands were purchased mostly from a single local retail outlet." (P. 323). *

Whether the 12 cigarettes were derived from one pack, two packs, six packs, or a carton cannot be ascertained. In addition, it is apparent from the report that not all lengths of cigarettes sold under the same brand name were sampled, and most certainly that the most widely consumed lengths of particular

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* In this connection there is the curious reference by Moore (page 324) to a "survey of local retail markets" to demonstrate that one brand of cigarette was on sale in three different designs of package. At the very least, the failure to distribute the purchases in the single locality among retail outlets is difficult to understand.

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brands were not either selected or analyzed. Compare Table 1, pp. 324-25.

For its purposes the Commission cannot follow that type of sampling. It cannot limit its testing to brands arbitrarily chosen and purchased from a single retail outlet in one location. It cannot be in the position which Moore forthrightly admits is true of his sampling and testing -- that cigarettes purchased in different localities might give different results. (P. 330).

The sampling deficiencies cannot be ignored by the Commission in any smoking tests in which it engages as a regulatory agency. Commission test results must reflect to the fullest extent possible what is available to the consumer at large, and not merely what a few consumers purchasing their cigarettes in a single retail outlet are smoking. There must be sufficient pick-up points to permit the market sample to approach a reasonably representative sample to which conventional statistical formulas may be validly applied. The 50 point pick-up we recommended will not be a true probability sample, yet for practical purposes, considering the many other inescapable variances in the Ogg Method, it may be considered sufficiently representative to be utilized.

It is further made clear from the Moore report that in selecting the 12 cigarettes to be tested, there was performed a series of manipulations which served further to make the cigarettes

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actually smoked even more unrepresentative. After conditioning there was selected, from whatever the quantity purchased may have been, only those cigarettes that fell within prescribed weight ranges. (P. 323).

It is true that in his effort to evaluate an analytical technique, Dr. Ogg described a weight selection step. This was of course appropriate in obtaining a uniform sample for evaluating a method. In our recommendations to the Commission, however, we strongly urged that this type of weight selection be omitted because the Commission had to be able to measure what the consumer finds in the market place. (Technical Data and Recommendations -- Determination in Reporting of Total Particulate Matter, November 28, 1966, Page 3).

Moreover, Ogg weight selected cigarettes within plus or minus 20 mg. Apparently in recognition of the paucity of the sample to be smoked, Moore and his colleagues isolated the cigarettes to be smoked on the basis of a more stringent selection, e.g., plus or minus 5 mg. (P. 323). How much of the quantity originally purchased was thus eliminated cannot be determined.

The second step in the Moore double restriction of the 12 cigarettes to be smoked was to pick out only those within prescribed ranges of resistance to air flow. Coupled with this, and even more difficult to understand, was his wrapping of each one

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of the cigarettes in aluminum foil. This may imply that the smoking itself was not done in air-conditioned laboratories. If the smoking room was air conditioned, then it is obvious that to a considerable degree the wrapping in aluminum foil would defeat the air conditioning. Finally, it is common experience that handling of cigarettes like wrapping and unwrapping cigarettes in foil, results in a degree of damage which can affect PM and nicotine yield.

What cannot be challenged is that most of these manipulations were a wide departure from the Ogg Method. That makes all of the later testing steps, reported results, ranking of brands, and conclusions of Moore open to serious challenge.

As will be indicated below, the paradox is that even after these manipulations of the sample, the precision obtained by Moore still did not remotely justify the results or the method of reporting in his Table 2. See infra pages 19-26. *

IV.

STATISTICAL DEFICIENCIES DERIVING FROM THE INADEQUATE SAMPLE AND TESTING METHOD

"The confidence intervals used in the text

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* As a further curiosity in the Moore sample is the fact that in reporting the physical characteristics of the sample smoked, according to the length of the cigarette, it is stated that they were measured to the "nearest 5 mm." (Footnote to Table 1, p. 324).

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> are based on pooled variance estimates together with a separate test of (the brand used as a monitor), and the interval for the separate test (25.3 to 29.3), includes all of the yields shown in Figure 6. Under the circumstances, the confidence intervals used in Figures 2 through 5 seem to provide an adequate indication of the reproduceability of the results." (P. 330).

An elementary examination of the statistical data included in the Moore paper demonstrates that the results reported in his Table 2, entitled "Average Tar and Nicotine Per Cigarette", are wholly unreliable and deceptive.

In part these deficiencies derive from the hopelessly inadequate sample of 12 cigarettes actually smoked. In greater measure, they result from the statement of PM results and the ranking of cigarette brands in Table 2 with minute exactitude in the face of obvious margins of error disclosed elsewhere in the Moore report, but not indicated in Table 2.

Those margins of error, it will be seen, range as high as 6 mg. Nevertheless, Moore reports his results and rankings by differences to a tenth of a milligram of PM. In effect, he measured only to the nearest foot, yet without qualification reported and ranked his results for public purposes in precise quarter inches.

The inadequate and unrepresentative character of the small sample smoked has already been delineated. The statistical deficiencies it caused can be readily demonstrated.

Source: https://www.industrydocuments.ucsf.edu/docs/pzwk0001

Moore reports the margins of error he found within each brand of cigarette in a series of graphic representations, entitled "Figures 2 through 5," (pp. 327-28). These Figures show confidence intervals. A 95% "confidence interval" means that one can assert that in 95% of the cases the interval or spread shown contains the true value. That true value can lie at any point within the confidence intervals in Moore's Figures 2 through 5. Moreover, since Moore smoked only 12 cigarettes, his confidence intervals are at best only crude estimates of these margins of error.*

Because the sample size was so small, Moore apparently had to pool the variances found for the brands of cigarettes tested, in order to get a reasonably stable variance. (See page 325). Consequently, Moore does not give the actual variances disclosed within each brand.

Nevertheless, an examination of Moore's Figures 2 through 5 makes it abundantly clear that the confidence intervals, e.g., the range of error in his results, varied markedly from brand to brand. For example, in Figure 4, when one looks at the group of brands with reported PM yields between 20 mg. and 24.9 mg., several of the confidence intervals are obviously smaller than the others in that same group. Thus the range of error in the final Table 2

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* See Freund, Modern Elementary Statistics, (1960, p. 216).

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listing is different for each brand.

Yet the remarkable thing in these Figures 2 through 5 is that the disclosed confidence intervals not only substantially vary in magnitude from brand to brand but the margins of error are also unacceptably wide in almost all cases. The confidence intervals vary from 2 to 6 mg. in magnitude. This fact carries two serious consequences. It demonstrates that the results, as reported in Table 2 for PM, are wholly unreliable because particular PM levels reportedly could vary in fact within that spread of values. And if one accepts Moore's testing of this sample of doubly selected cigarettes as a base, his own variances confirm that a sample size approaching 200 cigarettes is essential for any sound results.

First, to corroborate these points in further detail, on Moore's own data any two brands of cigarettes must differ by about 3 mg. (or on the order of one confidence interval) before anyone can state, with the confidence limit taken, that they are in fact different in PM yields as reported in Table 2.

For example, in Table 2 one brand is listed as yielding 27.0 mg., and Figure 2 discloses that the confidence interval, or the range of possible error, for that brand was 4 mg. This means that the true value for that particular brand lies between 25 mg. and 29 mg.

Source: https://www.industrydocuments.ucsf.edu/docs/pzwk0001

If these disclosed margins of error were applied to the top ten brands reported in Table 2, the relative rankings would change. The first reported as 8.3 mg., could according to Figure 4 equally be 9 mg., whereas the third, reported as 9.7 mg. could be less than 9 mg. The fifth reported as 12.3 mg. could be more than 13 mg. as against the sixth brand, reported as 13.6 mg. which could be less than 13 mg. Obviously, the relative rankings are not established with any certainty. As to the brands in the remainder of Figure 4, as well as in Figures 2, 3 and 5, the relative rankings are even more meaningless.

In short, when the results for a particular brand reported in Table 2 are measured against the confidence intervals disclosed for the same brand in these Figures, Dr. Moore's own work shows that any specific listing -- to the nearest tenth of a milligram -- is a prize example of implied certitude without statistical warrant.

The same difficulty exists throughout. By ready reference to Table 2, which presumes to report average values to a tenth of a milligram for the purpose of ranking brands, it can be seen that no less than 12 brands lie within the range of 25 mg. to 29 mg. But again looking at Figures 2 through 5

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it can be seen that at least 19 brands had confidence intervals or margins of error which overlapped the 25 to 29 mg. range.

The point is that in any testing program which has as its cardinal objective meaningful brand listings of PM, the large confidence intervals shown in this Moore work could not be tolerated by the Commission. That technique, deriving from the wholly inadequate sample, would plainly mislead the public into viewing differences in PM values among brands where the minutely listed differences are not established.

The statistical deficiencies in the Moore report in and of themselves demonstrate, moreover, that our suggestion of a working minimum of 200 cigarettes per brand to be smoked for any reliable statistical average is the necessary minimum. This can also be readily demonstrated. The only way in which such confidence intervals can be reduced to reasonable values is by smoking more cigarettes. A confidence interval of 1 mg. would seem to be reasonable since this would mean that the maximum error in the mean will be .5 mg. or less, with 95% confidence.

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(See Technical Data and Recommendations, November 28, 1966, pp. 4-7).

In order to obtain results which have a confidence interval of 1 mg., it is necessary to smoke at least 16 times as many cigarettes as Moore smoked, i.e., 192 cigarettes. * It is for this reason that we recommended a minimum of 200 cigarettes per brand as a first approximation.

Indeed, in his Figures 2 through 5, Moore discloses confidence intervals as high as 6 mg. (See the second brand in Figure 3). In this instance, the mean (average) value reported in Table 2 is 33.0. The result in fact lies somewhere between 30.0 and 36.0 mg. If that confidence interval were additionally used to determine a minimum required sample size, with a confidence interval of 1 mg., well over 400 cigarettes of each brand would have to be smoked.

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* The length of a 95% confidence interval is approximately $4\,s/\sqrt{n}$ where s is the standard deviation of the cigarettes smoked and n is the number of cigarettes smoked. To decrease the length of the confidence interval by a factor of 4, it is necessary to increase $\sqrt{n}$ by a factor of 4, that is, to increase "n" by a factor of 16. Hence Moore's sample of 12 multiplied by 16 yields 192 cigarettes.

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A further reason for not selecting a sample size of less than 200 cigarettes is that the Commission must be certain that its sample size is large enough to permit a meaningful application of conventional statistical formulas. Any sample size of less than 200 raises fundamental doubts in this regard.

These were in fact the bases on which the statistical experts testifying at the Commission's November 30, 1966 hearing and submitting written recommendations — such as Dr. Herbert Arkin and Mr. Walter Hendricks — were in accord in advising that 200 cigarettes per brand is an absolute minimum. The large uncertainty accompanying each brand value in the Moore paper firmly supports that conclusion. *

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* As a final point demonstrating the complete unreliability of Moore's report, PM results, and the conclusions in his paper, is the data given in Figure 6, presumably to demonstrate that his testing was properly done.

As the Commission is aware, to develop any comparative list of PM values with smoking machines employing the Ogg technique, it is always essential to test a standard or monitor cigarette concurrently over the period of testing. Only in this way can one reflect the smoking machine and operator variables from day to day. Moore reports (p. 326) that the brand he employed as a monitor "was remarkably constant, averaging about 27 mg. per cigarette."

Nevertheless, Figure 6 indicates that the results from the control cigarette over eight days of testing, between September 7 and September 14, showed a variation in (cont'd)

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The Commission therefore cannot adopt an unrepresentative sample of a sample size of less than 200 cigarettes per brand without throwing a major statistical cloud on its results, inducing misleading brand comparisons, and subjecting itself to serious scientific criticism.

Another inexplicable curiosity turns up in Moore's Table 2. Twelve of the brands there reported had also been previously reported by Moore in August, 1966. For almost all of these brands, the results in Table 2 are identical as to PM and nicotine with the values reported in August, 1966.* It is far from clear whether the August results were rerun, or whether they have been here consolidated without indication, and in terms of the monitor cigarettes whether the same monitor was used in the earlier testing with the same daily variances. This type of coincidence warrants explication.

(cont'd) the mean of as much as approximately 20% in PM. On that basis, his testing could be approximately 20% off on every other value for any 12 cigarettes of a brand that was smoked on that day. It is not suggested that the results derived from smoking each of the brands tested were on each day corrected by the percentage variations found on that day in the control cigarettes. But the conclusion cannot be escaped that many of the comparisons shown in Table 2 could be in error by as much as 20%.

* Press Release, August 29, 1966, Roswell Park Memorial Institute News Service.

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In summary, the statistical deficiencies plainly disclosed in the Moore paper demonstrate beyond challenge that the results and conclusions in that paper are wholly unreliable. What is equally plain is that the data supplied in Figures 2 through 6 make it clear that both the mean values given and the rankings offered in Table 2 cannot represent sound statistical conclusions and are therefore misleading. Even more, these data abundantly confirm the necessity for a sample size of not less than 200 cigarettes, and a pick-up from which that size sample is derived of not less than two packs at 50 different locations.

V

DECEPTIVE REPORTING OF RESULTS

> ". . . since their confidence intervals overlap widely, the test system does not show distinct differences among these brands in any event and the ordering is largely fortuitous whichever way the yield is expressed." (Moore, p. 329).

In the light of his wholly unrepresentative and unacceptably small samples, and the statistical deficiencies plainly revealed in the paper, the technique of reporting the testing results and rankings employed in the Moore paper are both scientifically unfounded and plainly deceptive.

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It will be recalled, supra, pp. 13-16, that the underlying broad confidence intervals for the values given in Table 2 rendered those reported values wholly unreliable within parameters of up to 6 mg. A reported value in Table 2 of 33.0 mg. might have been 30.0 mg. or 36.0 mg.

Nevertheless, in his Table 2 Moore presumes to report PM values to the nearest one-tenth of a milligram. That attempted certitude violates the generally accepted scientific convention for showing any testing results only to significant figures.

It is no answer to suggest that to a trained statistician, the Moore paper offers enough to permit this adjustment to be considered and evaluated. In the first place Table 2, listing the results and the rankings to the nearest one-tenth of a milligram, is in no way qualified, footnoted, or cross-referenced to the disclosed variances in Figures 2 through 5. Past experience indicates that Dr. Moore, in press releases, reports only the results in the form stated in his Table 2, and it is a fact that Table 2 without the necessary qualifications was offered to the public.

Those results and rankings, which were widely carried by the major news services, major networks, and leading magazines, received extensive press coverage. In view of the large margins

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of error admittedly existing in the publicized values, a large part of the population was clearly misled. *

Given the wide variances disclosed, elementary scientific forthrightness required that Moore round his results to the nearest whole milligram and express those results to reflect the variances obtained. He should make clear that a reported PM value of 27 mg. meant 27, plus or minus 2 mg., or that 33 mg. meant 33 mg., plus or minus 3 mg. Even more important, the rankings among brands should have been similarly qualified when reported in Table 2. Only in that fashion, on these data, derived from a miniscule sample, with his Figures plainly showing this magnitude of variance, could Table 2 have been made honest. Reporting and ranking cigarette brands on the basis of the nearest one-tenth of a milligram is per se deceptive.

Only where a sample size is adequate, and the testing procedure so performed as to keep these margins of error well under 1 mg., would it be permissible to report results only in unit milligrams.** One of the questions raised by the Commission

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* The Moore results will undoubtedly have some effect upon consumers' brand selection and even affect the market value of the tobacco company stocks. "The study undoubtedly will have some impact on the brand preferences of the smoking public." See Value Line Selection and Opinion, Tobacco Industry Analysis 1220 (April 7, 1967).

** In this connection, inter-laboratory variances which occur because of the inherent limitations in the Ogg Method must also be considered. See Supplementary Observations Following November 30, 1966 Hearing, pp. 7-8.

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in its Notice of Public Hearing of November 4, 1966 (Federal Register, p. 14278) was whether

> ". . . test results should be reported in terms of whole numbers or whole numbers and fractions of milligrams or a range, or a figure accompanied by the standard deviation with an explanation."

It was our recommendation that reporting should be made only to the nearest whole milligram. That recommendation was based upon the desire for simplicity and understandability in any reports which the Commission might make. But our recommendation was grounded on the testing of a sufficient number of cigarettes in order to reduce the maximum error to 0.5 mg. We still believe that showing margins of error might be confusing to non-statisticians, but this does not mean that test results which are wholly unreliable, within a range of 6 milligrams -- because of the inadequate sampling and disclosed wide margins of error -- may be blandly offered to the public. To do so in terms of tenths of milligrams warrants a charge of plain deception.

On the reporting of results, the Moore paper is misleading in at least two other important respects.

The first is the refusal to report PM and nicotine values both on a per puff and a per cigarette basis. Curiously, Moore's Table 1 makes it clear that he had the available data

Source: https://www.industrydocuments.ucsf.edu/docs/pzwk0001

for doing so because on that Table he reports "Average Puffs Per Cigarette." Moreover, it is widely recognized that individual smoking habits vary enormously both in the number of puffs per cigarette and the butt length to which the cigarette is smoked. It is implicit in such recognition that for many smokers a more meaningful expression of smoke quantity than that of total quantity collected per cigarette is the particulate matter or nicotine per puff. At the very least, values should be reported both on a per puff and a per cigarette basis.

Moore's reason for rejecting per puff reporting is that the disclosed distribution of data controlling rankings would yield essentially the same results whether his values were reported on a per puff or per cigarette basis. (See quotation from p. 329 above.) His own data contradicts that assertion. If one takes the reported average puffs from Table 1 and divides them into the PM and nicotine values given in Table 2 and then ranks brands by average PM and nicotine per puff, the disclosed differences in the relative ranking of the various brands are striking. One brand comes out 19 places lower in PM and nicotine ranking; two other brands 15 places higher; two other brands 18 places lower; and another brand 14 places higher when results are reported on an average per puff basis. Equivalently, the percentage differences among brands vary widely. Two which are

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45 percent different on a per cigarette basis are found to vary only 11 percent on a per puff basis.

These differences in relative rankings and in percent differences between brands make per cigarette results alone misleading to the smoker to whom per puff results would be more meaningful. Despite Moore's generalizations, the two methods of reporting simply do not produce the same results. Therefore, failure to report results on an average per puff as well as on an average per cigarette basis inescapably creates bias.

The misleading nature of results reported only per cigarette is confirmed by Table 1 in the Moore paper. Given the large differences in the average number of puffs for different brands tested and the large differences in the average butt length to which these cigarettes were smoked, reporting only on a per cigarette basis and then comparing results for different brands reported, is comparing wholly disparate values. Valid scientific comparisons cannot be made between two values obtained by different testing conditions unless the values are reported in such a way to eliminate test differences. Reporting on a per puff basis, when coupled with smoking to a 30 mm. butt length, minimizes this problem.

A further defect in Moore's reporting technique resides in his testing and reporting in a single Table brands of cigarettes

Source: https://www.industrydocuments.ucsf.edu/docs/pzwk0001

of varying lengths and type, including both filter and nonfilter cigarettes in the various length groups. Presumably this is related to his conclusion that the longer a cigarette the greater will be the PM and nicotine under the Ogg Method which standardizes both puff frequency and puff duration.

But this built-in factor in the Ogg Method lends no support to the Moore assumption that smokers would smoke just as many of the longer length cigarettes as they would of the shorter lengths. The suggestion is that the number of cigarettes smoked each day is a stable characteristic. (P. 331). There is no support for this assumption. Experience is to the contrary. Smoking habits widely vary, and, indeed, the longer cigarettes not only are not smoked at the same frequency as the shorter lengths, but also the longer lengths are smoked to a longer butt length.

This defect in the Moore reporting technique leads to a further suggestion that should well be considered by the Commission. Reporting on both a per cigarette and a per puff basis should be coupled with reporting PM and nicotine values by length and type of cigarette. The results should be grouped by cigarette length, and then by filter and nonfilter type under each length. When this is done, the smoker who alone knows his own smoking

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habits, can make a better evaluation in the light of these categories. He can do so in terms of the total cigarette or in terms of the frequency of puffing in his own smoking habits.

VI

BUTT LENGTH

The butt length to which cigarettes are smoked is a crucial parameter in the Ogg methodology which was built on a 30 mm. butt length. We have previously urged that 30 mm. or alternatively 3 mm. beyond the filter overwrap, whichever is the longer, be employed. That recommendation rested on two factors that were abundantly confirmed in the Commission hearings on November 30, 1966.

In the first place, an average butt length must be employed because every other factor in the Ogg Method -- puff volume, puff duration, puff frequency -- is standardized as an average in the Ogg procedure. To utilize some arbitrary shorter butt length on this controlling parameter not only modifies the developed method but also distorts the results.

That 30 mm. is the appropriate average butt length was confirmed at the hearing by numerous witnesses including Dr. Ogg, Dr. Hammond, and Dr. Hobbs. Each testified that the average butt length for American smokers was 30 mm. No witness

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testified to an average butt length of less than 30 mm. * Moreover, it has been established that 90% of the filter cigarettes produced in this country cannot be smoked to 23 mm. It is not rational to adopt a standard butt length that is inapplicable to the great majority of the brands currently being sold. Nevertheless, Moore set up a procedure for smoking to 23 mm. or to 3 mm. beyond the filter overwrap. ** It is worth noting that in the testing employed, his operators often missed that butt length by more than 2 mm. See Table 1, pp. 324-25. If the average butt length smoked was off by that amount, in many instances the deviations in length actually smoked were greater. Deviations of that degree suggest a deplorable lack of care in the entire testing.

But, more important, there is no warrant for initially selecting 23 mm. as an average butt length. Indeed, Moore's primary reliance is on a paper by Hammond and Wynder (Footnote 10)

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* See note, p. 9, of Supplementary Observations Following November 30, 1966, Hearing.

** It cannot be forgotten that a milligram is only one-twenty-eight thousandths of an ounce. A shorter butt length gives results apparently higher in PM and nicotine and thus exaggerates differences that are unrelated to smoking and health.

Source: https://www.industrydocuments.ucsf.edu/docs/pzwk0001

which in fact reported an average butt length of 30.9 mm. for American smokers. * Moore also relies on this same study for his statement that "the average butt was clearly shorter for cigarettes without filters than for those with them." (P. 329). The paper cited shows no such comparison, and an earlier Hammond paper, based on the same study, reported for American smokers an average butt length of 30.7 mm. for nonfilters and 31.0 mm. for filter cigarettes. In short, there is no basis for arbitrarily selecting a butt length lower than the average for American smokers.

VII

WET VERSUS DRY BASIS

Whether PM should be reported on a wet or dry basis has previously been canvassed for the Commission. The Moore paper concedes (p. 330) that moisture content of PM varies from 7% to 14%. But Moore then concludes that "differences in moisture content between brands is not sufficiently great to change the relative ranking in either Table 2 or the various figures." (Id.)

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* Moore's other references on butt length are not persuasive. Footnote 5 refers to Coresta, a European standard which the Hammond and Wynder paper demonstrates is irrelevant because Europeans smoke to a markedly shorter butt length than Americans, the latter smoking to an average of 30.9 mm. Footnote 4 refers to a thirty year old 1937 study concerned with smoking two-thirds of the 70 mm. cigarette, the only type then common.

Source: https://www.industrydocuments.ucsf.edu/docs/pzwk0001

This assumption is incredible. Moore, of course, made no moisture determinations on the cigarettes he tested. The paper by Sloan and Sublett, on which he relies for the range of 7% to 14% moisture, was based on smoking cigarettes to a 30 mm. butt length. Water content of PM increases markedly as the butt length is shortened from 30 mm. to 23 mm.

Yet even accepting (absent no data) that at 23 mm., the range is 7% to 14%, moisture content differences can affect the PM values by 1.4 mg. at a PM level of 20 mg. The variances in cigarettes and inherent in the Ogg Method would be measurably increased. This failure to deal with water -- and water is not "tar" or PM -- would alone render any testing results unacceptable. *

VIII

SAMPLE CONDITIONING

Moisture content of cigarettes is related to conditioning. Moore reports (Figure 7) that equilibrating the control cigarettes at 20%, 60% and 100% relative humidity for 48 hours

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* In the case of the Moore Table 2, the failure to deal with moisture variance accentuates every other deficiency, and makes the reporting to a tenth of a milligram and rankings of no value whatever.

Source: https://www.industrydocuments.ucsf.edu/docs/pzwk0001

had very little effect on PM yield. (P. 326.) A cigarette equilibrated at 100% relative humidity would end up with above 25% moisture content. It would be too wet to be smoked on a machine under the conditions reported. Figure 7 and Moore's comment throw grave doubt on the conditioning in the laboratory in which he tested.

IX.

CONCLUSION

The foregoing critique of the Moore et al. report, published in the March 1967 issue of "Cancer", reporting results to tenths of milligrams on "Tar and Nicotine Retrieval From Fifty-Six Brands of Cigarettes," confirms in every respect the recommendations made to the Commission in the many informal discussions with the Staff and at the Public Hearing on November 30, 1966. The sampling difficulties, the statistical deficiencies, and the deceptive and delusive exactitude in the reporting and ranking of results found in the Moore paper are starkly revealed. Not since Procrustes stretched or cut travelers to fit his arbitarily measured bed has a like effort to distort and overstate data been seen. It is respectfully submitted that the Commission in its effort to establish a scientifically adequate method

Source: https://www.industrydocuments.ucsf.edu/docs/pzwk0001

of testing cigarettes and a reliable method of reporting results must avoid the disclosed shortcomings in the Moore paper.

Respectfully submitted,

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April 10, 1967

Source: https://www.industrydocuments.ucsf.edu/docs/pzwk0001